Volume 1, Issue 2

Summer 2004

MARYLAND DEPARTMENT OF HEALTH AND MENTAL HYGIENE

Environmental Public Health Tracking

In this Issue:

EPHT Maryland Summer 2004

Don't forget to mark July 13th on your calendar for the *Data Collection & Data Sharing* workshop at University of Baltimore. Contact Betty Dabney (bdabney@mde.state.md.us) at the Department of the Environment for more information or visit the DHMH website.

This issue showcases the implementation of GIS techniques otherwise novel in the public health and shows a glimpse into future EPHT research. As always we welcome your participation and questions as we move the vision of EPHT forward!

Andrew Timleck

Environmental Public Health Indicator Conference, Boise, ID June '04

The annual meeting of the Council of State and Territorial Epidemiologists met with the CDC and CSTE to come up with indicators that can be used to evaluate national efforts to reduce environmental hazard associated morbidity and mortality. The meeting allowed states to make presentations and opened discussion on many issues related to EPHT and indicator choices. For example, Montana selected childhood lead poisoning because past and current mining activities. New Mexico chose asthma because the state's power generating plants continue to release air pollutants and New York City chose pesticide monitoring. Maryland selected the Indicators for ozone in ambient air as the environmental hazard and asthma as the chronic disease.

Dr. John Braggio

Maryland's Environmental Public Health Tracking Program

The Maryland Department of Health and Mental Hygiene (DHMH), along with Maryland Department of the Environment (MDE), are co-recipients of a national Environmental Public Health Tracking (EPHT) grant funded by the Centers for Disease Control and Prevention (CDC). Environmental public health tracking is "…the ongoing collection, integration, analysis, and interpretation of data about environmental hazards, exposure to environmental hazards, and human health effects potentially related to exposure to environmental hazards" (Pew Environmental Health Commission). It also includes dissemination of results from these efforts, and education and outreach components to stakeholders inside and outside state agencies.

Using the grant funding, the EPHT program in Maryland will identify major environmental data sources in the state, along with major sources of information on human diseases, and evaluate them for potential linkage and integration in a GIS-based system. Such linkage would allow researchers to understand what possible associations might occur between environmental exposures and human disease.

In addition to building the inventory of environmental and health databases, the Maryland EPHT program will carry out a demonstration project that links selected environmental data with health outcomes in childhood asthma and leukemia. These two diseases are of interest because they occur more frequently in Maryland than the U.S.

The state EPHT program is also conducting surveys of environmental and health data users, as well as organizing education and outreach programs to reach different groups of stakeholders who need to use health and environmental information. As part of this outreach, there will be a one-day workshop on Data Collection and Data Sharing at the University of Baltimore on July 13th. All environmental and health professionals, as well as other interested individuals, are invited to attend (see contact information provided below).

Maryland is one of twenty grantees composed of states and large city health departments. In addition, there are three regional academic Centers of Excellence to support and enhance the efforts of the grantees. Johns Hopkins Bloomberg School of Public Health is the regional Center of Excellence working with MDE and DHMH on the EPHT program. The CDC has also formed partnerships with other organizations and agencies for the EPHT program, including the U.S. Environmental Protection Agency, the Environmental Council of the States, the National Aeronautics and Space Administration, and several national public health organizations.

According to Dr.. Julie Gerberding, Director of the CDC, "CDC's National Environmental Public Health Tracking Program is building a national integrated environmental and public health information system that supports national efforts to standardize and facilitate the electronic exchange of information. Linking environmental and health data will enable a timely response to potential public health problems related to the environment."

Ultimately the EPHT program may become the basis for routine public health monitoring in relation to environmental conditions. It may play a role in detecting and preventing disease outbreaks in a timelier manner, with the ultimate goal of improving the public's health.

More information on the national and Maryland EPHT programs can be found on their web sites: http://www.cdc.gov/nceh/tracking and http://epht.dhmh.state.md.us/ . For more information on the Summer Workshop, contact Dr. Betty Dabney at bdabney@mde.state.md.us or 410-537-3851.

Geo-statistics—An EPHT Companion

Geo-statistics is a set of statistical methods to better comprehend the relationships in spatial data using various spatial models. It gives one power to statistically predict and model phenomenon by incorporating powerful statistical tools. Geo-statistics allow for data exploration, identification of data inconsistencies, data modeling, prediction mapping, and probabilistic mapping using various visualization tools. Simply, geo-statistics effectively bridge the gap between statistics and GIS.

The use of geo-statistics can be extremely beneficial for monitoring public health due to environmental exposure. For example, understanding the geographic distribution of disease can aid in identifying important risk factors contributing to disease incidence. Determining the spatial distribution of environmental exposures can be an important component of this understanding. Analytical maps of both disease and potential exposure form the basis for geographical correlation studies that attempt to make assumptions about disease risk in relation to environment risk factors. Recent advances in geo-statistics in collaboration with GIS have made it easy to analyze exposure data by providing objective, data driven methods for quantifying trends and detecting patterns in spatial data. Hence, geo-statistics are a true companion of EPHT.

Example: Mapping radiocesium food contamination data collected in Southern Belarus in 1993

The event that beset the nuclear power plant at Chernobyl in the Ukraine on April 26, 1986 is the most striking of all environmental disasters. Due to the long half-life of radiocesium (about 30 years) that was deposited across Europe, agricultural effects have continued to last many years after the immediate health effects had ceased. This map used ordinary lognormal cokriging on residuals, obtained by estimating a low-order polynomial function of the spatial locations and then subtracting this function from the data values. The residuals were transformed to be normally distributed using a log transformation. Additional spatial information about cesium concentrations in wild mushrooms was used with the data on radiocesium milk contamination to make the predictions, and the results were then back-transformed and corrected for bias before mapping. This procedure sounds complicated and there is indeed much statistical theory behind it, but using the ArcGIS Geostatistical Analyst extension this map can be created in a few minutes.

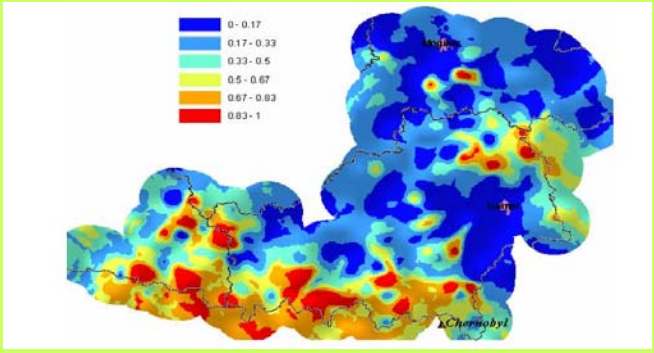


Figure 1. Probability that radiocesium milk contamination was larger that half of upper permissible level in 1993 (ordinary lognormal cokriging).

Public Health GIS News and Information (January 2004, ESRI)

Maryland EPHT GIS Pesticides Study

We are using GIS to estimate pesticide usage on Maryland field crops identified with remote satellite sensing. Identification of crops through remote sensing has several advantages. Actual usage rates may be under-reported and are not available except at a county level. Using a method similar to that of Xiang *et al*[1] optimized for Maryland, we have started to analyze LandSat images at 30 m resolution to distinguish between different crop patterns. This method does not require ground truthing (independent verification of crop cover by ground-level observation). This pilot study is limited to four counties: two with relatively high pesticide usage, and two low usage counties. Images will be analyzed for two years, 1994 and 2000. Here are some images showing results obtained for patterns of crops in Charles County:

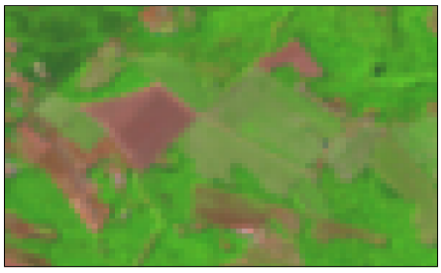


Figure 1

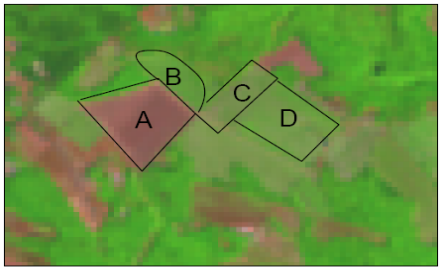


Figure 2

Two adjacent fields, A and B, appear to be identical to the unaided eye in the original LandSat image (Figure 3). After operation of the remote sensing algorithm, these fields are determined to be different (Figures 1 and 2).

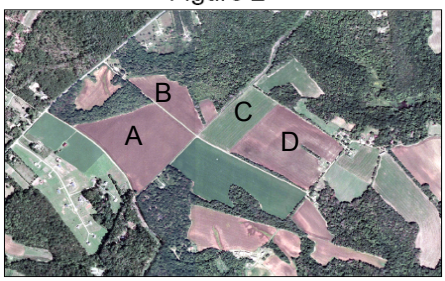


Figure 3

Such an approach also has several important weaknesses. Remote sensing gives only a "snapshot" of a single point in time. Many land patterns covering extended periods would need to be analyzed in order to obtain a better sense of continuous patterns of crop growth and, by inference, pesticide application.

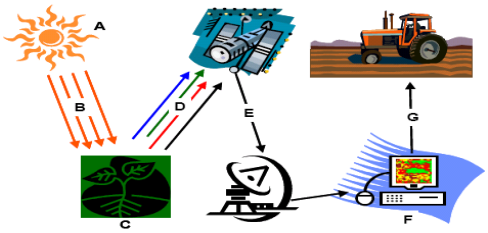
Other factors, such as yearly variation in climate and season, would also need to be taken into account to get better estimates of density of crop cover. Pesticide application rates are not available for individual fields, and need to be estimated from statewide or county averages. More importantly, the use of pesticides on particular fields does not necessarily imply that children living nearby were exposed to those pesticides at levels proportionate to their use. Nevertheless, similar approaches have been used in other studies, and there is a growing body of evidence that exposures tend to follow patterns of usage.

The next steps in the project will be to assign the crops based on their remote sensing patterns, to determine the most commonly used pesticides on those crops from the Maryland Crop Survey, and to calculate the amount of pesticides applied to each field from typical usage rates and the area. Finally, estimated pesticide usage will be linked with reproductive outcomes of low birth weights, birth defects and infant deaths. Results will be presented in future articles.

[1]Xiang H, Nuckols JR, and Stallones L: A geographic information assessment of birth weight and crop production patterns around mother's residence. Environ Res Section A 2000; 82:160-167.

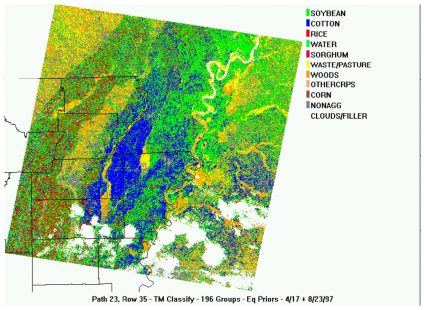
Eyes in the Sky - Bringing New Visions to EPHT

While use of remote sensing in geographic and space sciences is nothing new its implementation in public health is in its relative infancy But in a short while it's already showing great potential for tracking environmental contaminants or growth of disease vector populations, such as mosquitoes and West Nile Virus, to name just a few uses.



Remote sensing uses satellites orbiting the earth, regularly snapping "pictures" of the terra below as it changes. The pictures are actually complex images with multiple bands of information that are decoded based on reflective signature: different objects, even plants, reflect light at different wave lengths that is used to identify those objects and their locations ... within meters from 438 miles up!

So why use remote sensing? With GIS (Geographic Information Science) images can be decoded and used to track changes in ground moisture that might create breeding grounds for disease vectors. Or it can be used to detect air pollutants and their plumes, streams over a city, or the distribution of agricultural crops to determine areas over which pesticides might be used and their proximity to local aquifers, or recreational areas.



Remote sensing, combined with innovative uses of GIS, and solid public health epidemiology, promises to give a new perspective to the very near environment - from very far away.

EPHT Childhood Asthma & Leukemia Demonstration Project

Given the unique makeup of Maryland and the health needs of its citizens, we need a tracking system that permits the reporting and evaluation of exposures to environmental hazards and how they adversely affect morbidity and mortality. This EPHT demonstration project will provide an answer to this question - evaluating the association between air pollutants, pesticides and radon sources on incidence and prevalence of childhood asthma and a common form of childhood leukemia, acute lymphoblastic leukemia; 80% of children who have leukemia have ALL.

A GIS will be used to track the chronic disease patterns through de-identified patients and their zipcodes as well as environmental indicators of air pollutants (such as ozone and radon, particulate matter etc.)over two three year periods. The goal is to evaluate the hypothesis that there are zip codes where incidence or prevalence for childhood asthma and ALL are higher than in other zip codes and these same zipcodes will show higher levels of environmental contaminants.

Dr. John Braggio

EPHT Calendar—Upcoming Events

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Meetings and Important Target Dates

Completed collection of database survey - users and available data	July, 2004
Summer 2004 Workshop: Data Collection & Data Sharing	July 13, 2004, UBC Thummel Center (see DHMH website for details)
Completion of EPHT Pilot Project using GIS-Remote Sensing to track environmental health impacts	Sept/Oct, 2004
CDC "Grant B" application submitted: GIS and EPHT integration project	October, 2004

DHMH promotes the health of all Maryland citizens by providing health and support services; by improving the quality of health care for all; by providing leadership in the development and enactment of responsible and progressive health care policy; and by serving as the advocate for public health initiatives and programs to improve the quality of life for all Marylanders. Maryland's public health is our business

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DHMH
EPHT Quarterly

A publication of the Maryland Department of Health and Metal Hygiene, Information Resources Management Administration Division

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